Applicant: Elliott et al.
Appl. No: 10/042,509
Title: Predictive Algorithmic Model
Filing Date: January 2, 2002
Attorney: Jason D. Shanske, Reg. No. 43,915

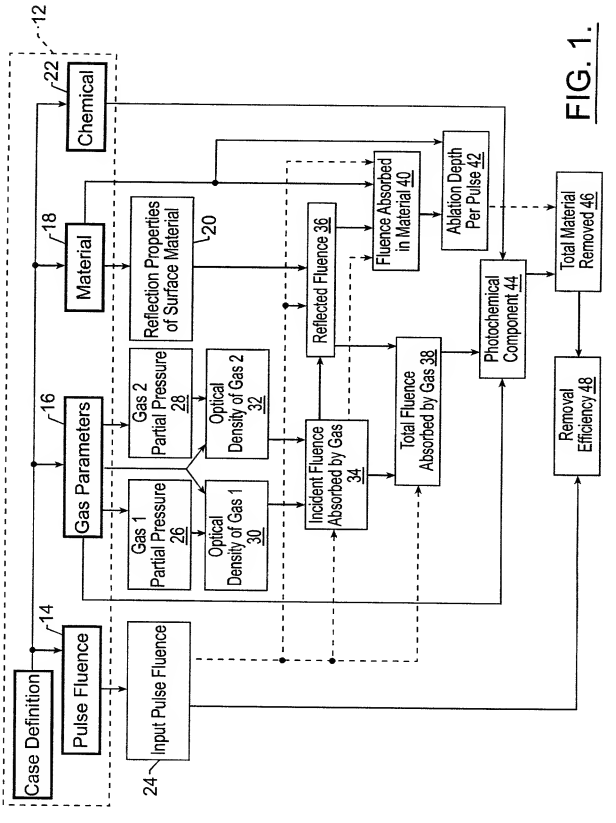

FIG. 1.

UV Tech Systems Inc., PhotoChemical Ablation Model
Case Definition
Removed Material
AZ 2400 Photo Resist
Reactive Gases
Ozone+ Oxygen
Laser Wavelength (nm)
193
248
266
355
Pulse Fluence
Base Fluence Value (mJ/cm2)
1
Fluence Increment (mJ/cm2)
30
Gas Parameters
Reactive Gases
Starting Partial Pressure (torr)
Partial Pressure Increment (torr)
Molecular Cross Section (x 10-20cm)
Gas 1 (Ozone)
1
0
67.50
1
0
810.00
1
0
762.75
1
0
0.07
Gas 2 (Oxygen)
499
0
0.000675
499
0
0.0000675
499
0
0
499
0
0
other
0
0
0
0
0
0
0
0
0
Total Pressure
500
500
500
500
Optical Path Through Gas (cm)
3
Material Parameters
Material Absorption Coefficient (micron-1)
10
1.73
1.73
0.146
Material Threshold (mJ/cm2)
5.19
30
30
350.68
Material Refractive Index
2.10
1.49
1.49
1.74
Angle of Incidence (Degrees)
0.1
Reflectivity Amplitude (s & p)
-0.31
-0.30
-0.27
0.31
0.30
0.27
Reflectivity Component (s & p)
0.13
0.10
0.09
0.07
0.13
0.10
0.09
0.07
Total Reflectivity
0.13
0.10
0.09
0.07
Chemical
Photo-chemical parameter 1
0.002
Photo-chemical parameter 2
0.02
Spectral Dependencies
Material Absorption
Gas Absorption
Absorption Properties (Arbitrary Units)
20
15
10
5
0
193
248
266
355
Wavelength (nm)
50
52
54
56
58
60
62

FIG. 2.

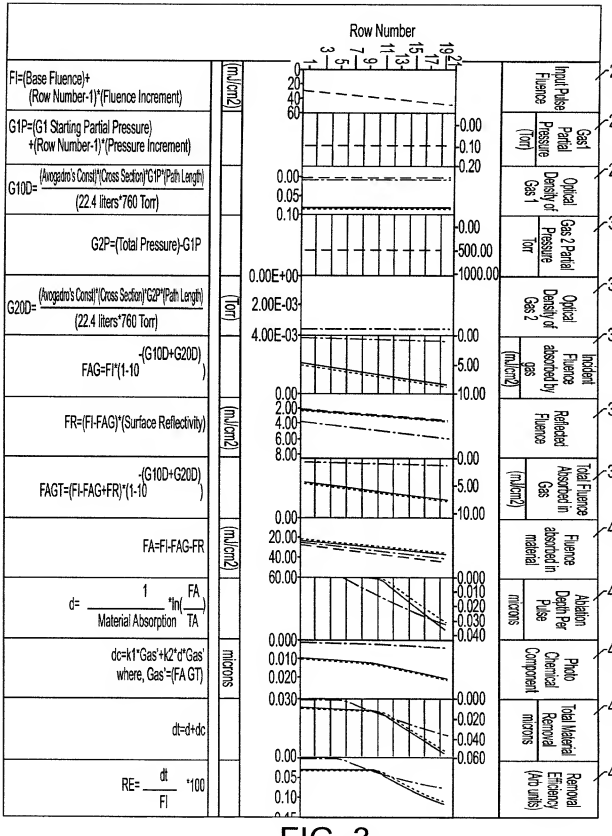
Row Number
FI=(Base Fluence)+ (Row Number-1)*(Fluence Increment)
G1P=(G1 Starting Partial Pressure) +(Row Number-1)*(Pressure Increment)
G10D= (Avogadro's Const)*(Cross Section)*G1P*(Path Length) / (22.4 liters*760 Torr)
G2P=(Total Pressure)-G1P
G20D= (Avogadro's Const)*(Cross Section)*G2P*(Path Length) / (22.4 liters*760 Torr)
FAG=FI*(1-10^-(G10D+G20D))
FR=(FI-FAG)*(Surface Reflectivity)
FAGT=(FI-FAG+FR)*(1-10^-(G10D+G20D))
FA=FI-FAG-FR
d= 1/Material Absorption * ln(FA/TA)
dc=k1*Gas'+k2*d*Gas' where, Gas'=(FA GT)
dt=d+dc
RE= dt/FI *100
(mJ/cm2)
(Torr)
(mJ/cm2)
(mJ/cm2)
microns
Input Pulse Fluence
Gas1 Partial Pressure (Torr)
Optical Density of Gas 1
Gas 2 Partial Pressure Torr
Optical Density of Gas 2
Incident Fluence absorbed by gas (mJ/cm2)
Reflected Fluence
Total Fluence Absorbed in Gas (mJ/cm2)
Fluence absorbed in material
Ablation Depth Per Pulse microns
Photo Chemical Component
Total Material Removal microns
Removal Efficiency (Arb units)
24
26
28
30
32
34
36
38
40
42
44
46
48

FIG. 3.

193 nm

24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48

Row Number	Input Pulse Fluence (mJ/cm2)	Gas1 Partial Pressure (Torr)	Optical Density of Gas 1	Gas 2 Partial Pressure (Torr)	Optical Density of Gas 2	Incident Fluence absorbed by gas (mJ/cm2)	Reflected Fluence (mJ/cm2)	Total Fluence Absorbed in Gas (mJ/cm2)	Fluence absorbed in material (mJ/cm2)	Ablation Depth Per Pulse (microns)	Photo Chemical Component (microns)	Total Material Removal (microns)	Removal Efficiency (arbitrary Units)
20	571	1.00	0.07	499.00	0.003573226	90.78	60.65	85.99	419.57	0.439	0.927	1.367	0.24
19	541	1.00	0.07	499.00	0.003573226	86.01	57.46	81.47	397.53	0.434	0.870	1.304	0.24
18	511	1.00	0.07	499.00	0.003573226	81.24	54.28	76.95	375.48	0.428	0.813	1.241	0.24
17	481	1.00	0.07	499.00	0.003573226	76.47	51.09	72.44	353.44	0.422	0.756	1.178	0.25
16	451	1.00	0.07	499.00	0.003573226	71.70	47.91	67.92	331.39	0.416	0.700	1.116	0.25
15	421	1.00	0.07	499.00	0.003573226	66.93	44.72	63.40	309.35	0.409	0.645	1.054	0.25
14	391	1.00	0.07	499.00	0.003573226	62.16	41.53	58.88	287.31	0.401	0.590	0.992	0.25
13	361	1.00	0.07	499.00	0.003573226	57.39	38.35	54.36	265.26	0.393	0.536	0.930	0.26
12	331	1.00	0.07	499.00	0.003573226	52.62	35.16	49.85	243.22	0.385	0.483	0.868	0.26
11	301	1.00	0.07	499.00	0.003573226	47.85	31.97	45.33	221.17	0.375	0.431	0.806	0.27
10	271	1.00	0.07	499.00	0.003573226	43.08	28.79	40.81	199.13	0.365	0.379	0.744	0.27
9	241	1.00	0.07	499.00	0.003573226	38.31	25.60	36.29	177.09	0.353	0.329	0.682	0.28
8	211	1.00	0.07	499.00	0.003573226	33.55	22.41	31.78	155.04	0.340	0.279	0.619	0.29
7	181	1.00	0.07	499.00	0.003573226	28.78	19.23	27.26	133.00	0.324	0.231	0.556	0.31
6	151	1.00	0.07	499.00	0.003573226	24.01	16.04	22.74	110.95	0.306	0.185	0.491	0.33
5	121	1.00	0.07	499.00	0.003573226	19.24	12.85	18.22	88.91	0.284	0.140	0.424	0.35
4	91	1.00	0.07	499.00	0.003573226	14.47	9.67	13.70	66.87	0.256	0.097	0.353	0.39
3	61	1.00	0.07	499.00	0.003573226	9.70	6.48	9.19	44.82	0.216	0.058	0.274	0.45
2	31	1.00	0.07	499.00	0.003573226	4.93	3.29	4.67	22.78	0.148	0.023	0.171	0.55
1	1	1.00	0.07	499.00	0.003573226	0.16	0.11	0.15	0.73	0.000	0.000	0.000	0.03

FIG. 4.